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Sun Protection Behaviors of State Park Workers in the Southeastern USA

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Abstract

Background: Due to the nature of their work, state park workers receive substantial exposure to sunlight, putting them at an increased risk of developing skin cancer. Increased use of sun protection behaviors can reduce this risk.

Objectives: Using the health belief model (HBM) as a theoretical framework, the purpose of this study was to assess factors associated with sun protection behaviors among state-park workers.

Methods: In this cross-sectional study, a convenience sample of participants were recruited from 23 state parks in the Southeastern USA to complete a self-administered questionnaire based on the constructs of the HBM.

Results: The sample comprised 310 state park workers. The majority of participants were non-Hispanic White (61.6%), male (63.5%), and were aged 39.56 (±13.97) years on average. The average duration of sun exposure during the workday was reported as 3.51 h (±1.88). Nearly 12% of the participants reported that their workplace had a sun-safety policy and ~10% reported receiving sun-safety training at their workplace. The majority of participants reported that they did not sufficiently use sun protection methods. Factors associated with sun protection behaviors included the HBM constructs of perceived benefits outweighing perceived barriers (standardized coefficient = 0.210,

$P = 0.001$), self-efficacy (standardized coefficient = 0.333, $P < 0.001$), and cues to action (standardized coefficient = 0.179, $P = 0.004$).

Conclusion: Future research should explore the barriers to adopting and enforcing sun-safety policies in the workplace. HBM appears to be efficacious in explaining sun protection behaviors among state park workers. HBM constructs should be considered in future interventions aimed at increasing sun protection behaviors in this population.

Keywords: health belief model; outdoor workers; skin cancer; state park workers; sun exposure; sun-safety

Introduction

Skin cancer is the most common of all cancers in the USA (Grossman *et al.*, 2018). Every year, more than 4 million individuals are treated for nonmelanoma skin cancer in the USA, and that number continues to rise (Islami *et al.*, 2018). Melanoma, although less common, is the deadliest form of skin cancer; 91 270 new cases of melanoma were estimated to be diagnosed in the USA in 2018, with 9320 mortalities (Siegel *et al.*, 2018). The most recent cost analysis estimated the average annual cost of skin cancer treatment in the USA to be $8.1 billion (Guy *et al.*, 2015).

Exposure to Ultraviolet radiation (UVR), primarily from the sun, is the main preventable risk factor for skin cancer (Greinert and Boniol, 2011). Primary methods of skin protection involve preventing or limiting exposure to UVR. The National Cancer Institute recommends the following actions to reduce the risk of skin cancer: reducing exposure to sunlight, particularly during peak hours (i.e. between the hours of 10 am to 4 pm); wearing protective clothing (e.g. long pants, long-sleeved shirts, wide-brimmed hats); and applying sunscreen with a sun protection factor (SPF) of 15 or higher (National Cancer Institute, 2016). Another preventive practice consists of checking the skin for signs of skin cancer, which can be performed either by one's self (skin self-examination) or by a medical profession (Mahon, 2003). It has been shown that limiting UVR exposure combined with regular skin examinations significantly reduces one's chances of developing skin cancer, whereas also reducing disease burden and mortality rate (Greinert and Boniol, 2011).

Excessive exposure to UVR is the most significant risk factor to skin cancer development (Horsham *et al.*, 2014). Owing to the ubiquitous nature of sunlight, individuals who must be exposed on a regular basis, such as outdoor workers, are at an increased risk of developing skin cancer (John *et al.*, 2016). Studies have demonstrated that outdoor workers are exposed to between 2 and 8 h of sunlight a day and receive between two and six times more UVR than indoor workers (Gies and Wright, 2003; Batra, 2010; Nahar *et al.*, 2013). Outdoor workers makeup a large proportion of the US national workforce that spreads across a broad range of occupations (Nahar *et al.*, 2013). Efforts must continue to identify the sun protection behaviors of various subgroups in an outdoor worker population, because the use of sun protection behaviors might differ because of specific job tasks (Salas *et al.*, 2005; Nahar *et al.*, 2013).

State park workers have a variety of responsibilities ranging from performing maintenance of park infrastructure and landscaping to patrolling the parks in a law enforcement and fire safety capacity (National Park Service, 2017). Given an absence of literature addressing state park workers' sun exposure and sun protection behaviors, we previously conducted a pilot study with a sample of 87 state park workers (Nahar *et al.*, 2014). Findings revealed that state park workers were exposed to UVR an average of 4.18 (±1.57) h between 10 am and 4 pm Despite receiving high UVR exposure on a daily basis, the majority of state park workers did not protect themselves adequately with sun protection measures (Nahar *et al.*, 2014). In the previous pilot study, components of the health belief model (HBM) were used to understand the use of sun protection measures; however, due to a relatively small sample size, the HBM constructs were not tested in explaining sun protection behaviors among state park workers (Nahar *et al.*, 2014).

Empirically testing theoretical models is an important step that should be conducted before using theoretical models for the planning of intervention strategies (Plotnikoff *et al.*, 2008). Therefore, the purpose of the current study was to test the utility of the HBM constructs in explaining sun protection behaviors among state park workers. Such a study is warranted because it will provide useful information that could be used toward the development and implementation of skin cancer preventative programs targeting state park workers or other subgroups of outdoor workers.

Theoretical framework

Developed in the 1950s by Hochbaum, Kegels, and Rosenstock, the HBM attempts to explain health behaviors by observing their relationship to the usage of health services. The HBM describes the decision-making process behind health behaviors as the result of interactions between perceived risk, benefits, and barriers to treatment, which are further modified by self-efficacy and cues to action (Hochbaum *et al.*, 1952). Individual perceptions of risk are shaped by the constructs of perceived susceptibility and perceived severity. Perceived susceptibility refers to how likely an individual believes they are to become ill, whereas perceived severity refers to how detrimental an individual believes an illness to be. When perceived risk is sufficiently high, an individual may wish to modify their behaviors; however, action is dependent on the relationship between perceived barriers and perceived benefits. Perceived benefits describe how effective an individual believes a health behavior will be at reducing their perceived risk. Perceived barriers are those obstacles an individual believes will prevent the adoption of a new behavior, and may include factors such as expenses, inconvenience, and pain. The HBM states that when an individual perceives their risk to be high for an illness and the benefits of change outweigh the barriers, only then they will modify their behavior (Sharma and Romas, 2017). However, behavioral change may be connected with other constructs associated with the HBM: cues to action, self-efficacy, and modifying factors. On occasion, a cue to action may be required to initiate behavioral change. A cue to action may be internal, such as the onset of symptoms, or may be external, such as being targeted by an educational campaign. Another construct, self-efficacy, was added to the HBM in the 1980s (Rosenstock *et al.*, 1988). Self-efficacy is the confidence that an individual has in his or her ability to pursue a certain behavior (Bandura, 1977; Sharma and Romas, 2017). Finally, modifying factors are those factors which alter an individual's perceptions and therefore their decision-making regarding health behaviors and may include demographic variables and structural factors such as knowledge about the disease and previous experience with the disease in question (Glanz *et al.*, 2008; Nahar *et al.*, 2013).

Methods

Participants and procedure

This study used a cross-sectional research design. Eligible study participants were employees currently working at state parks in the Southeastern region of the USA. Data were collected between June and August of 2013 from a nonprobability, convenience sample of state park workers. At a state-wide meeting, park representatives of 23 state parks were given packets that included an informational letter, a self-administered questionnaire, and a self-addressed stamped envelope, and were asked to make them available to employees at their respective state parks. Interested employees then had the option of completing the survey and mailing them to the researchers. Ethics approval for the study was received from Institutional Review Board at the University of Mississippi prior to conducting the study.

Instrumentation and measurement

A 73-item survey instrument was developed using questionnaires from prior research studies (Marlenga, 1995; Rosenman *et al.*, 1995; Shoveller *et al.*, 2000; Von Ah *et al.*, 2004; Salas *et al.*, 2005; Hammond *et al.*, 2008). A panel of three experts in the area of health behavior research assessed the instrument for face and content validity. Internal consistency reliability of the scales was established using Kuder–Richardson-20 and Cronbach's alpha. Questions assessed sociodemographic characteristics, skin cancer risk, skin examination behaviors, workplace sun-safety support, sun protection behaviors, skin cancer knowledge, and HBM constructs.

The sociodemographic characteristics were assessed by asking participants to self-report their gender, race/ethnicity, age, marital status, education, annual household income, and health-care insurance. See Table 1 for each category of sociodemographic characteristics.

For skin cancer risk, participants were asked to provide information about their skin type (with responses being always burn, never tans; usually burn, tans with difficulty; sometimes mild burn, gradually tans to a light brown; rarely burn, tan with ease to a moderate brown, very rarely burns, tans very easily; never burns tans very easily, deeply pigmented), personal skin cancer history (with responses being yes, no, I don't know), family skin cancer history (with responses being yes, no, I don't know), sunburns this summer, sunburns last summer, and average number of hours spent out in the sun between 10:00 am and 4:00 pm on a workday and weekend or day off (with responses being 1, 2, 3, 4, 5, and 6 h),

Questions on skin examination asked participants whether they ever had their skin checked for changes which could be skin cancer (with responses being yes, no, I don't know). If participants responded 'yes', they were also asked who checked their skin and when they had their most recent skin exam.

For workplace sun-safety support, participants were asked to answer whether their current workplace had a sun-safety policy (with responses being yes, no, I don't know). A follow-up question asked those who reported workplace sun-safety policies whether the policy was enforced at workplace (with responses being yes, no, I don't know). The participants were also asked whether they had

Table 1. Sociodemographic characteristics of the participants.

	n (%)
Gender	
Male	197 (63.5)
Female	108 (34.8)
Race/ethnicity	
White or Caucasian American	191 (61.6)
Black or African American	104 (33.5)
Hispanic or Latino	4 (1.3))
Asian	2 (0.6)
Other	2 (0.6)
Marital status	
Single	135 (43.5)
Married	135 (43.5)
Divorced	22 (7.1)
Separated	3 (1.0)
Widowed	3 (1.0)
Other	2 (0.6)
Education	
9–11th grade	33 (10.6)
High-school graduate or completed GED	89 (28.7)
Trade, technical, or vocational education beyond high school	4 (1.3)
Some college, without receiving degree	55(17.7)
2-year college degree	41 (13.2)
Bachelor's degree or higher	63 (20.3)
Other	6 (1.9)
Annual household Income	
Less than \$5000	14 (4.5)
\$5000–\$15 000	29 (9.4)
\$15 001–\$25 000	67 (21.6)
\$25 001–\$35 000	52 (16.8)
\$35 001–\$50 000	55 (17.7)
\$50 001–\$70 000	29 (9.4)
More than \$70 000	36 (11.6)
Health care insurance	
Yes	264 (85.2)
No	34 (11.0)
I don't know	7 (2.3)

Due to missing data, the percentage of participants in each category of sociodemographic characteristics do not sum to 100%.

any training at their workplace on skin cancer prevention (with responses being yes, no, I don't know) and what sun-safety equipment was provided to them by their employers (with responses being yes, no, I don't know).

Sun protection behaviors

The sun protection behaviors scale (Cronbach's alpha = 0.62) had seven items. A sample item from the scale states, 'During the summer months, how often do you perform following when you are in sun for more than 15 minutes between 10 am to 4 pm: seek shade, wide-brimmed hat, sunscreen, …' Each item was rated using five choices (1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = always). A total score for sun protection behaviors was obtained by adding scores for all items. The sun protection behaviors variable had a possible score range between 7 and 35 units, with higher scores representing higher use of sun protection behaviors.

Skin cancer knowledge

The skin cancer knowledge scale (Kuder–Richardson-20 = 0.82) had 10 true or false questions. Sample items from the scale include, 'Skin cancer is the most common form of cancer' and 'Sun exposure causes most skin cancers'. A total score for knowledge was obtained by adding scores of all items. The knowledge variable had a possible score range between 0 and 10 units, with higher scores representing higher skin cancer knowledge.

HBM constructs

The perceived threat of skin cancer scale (Cronbach's alpha = 0.66) had six items. Three questions were used to assess perceived susceptibility and three for perceived seriousness. Sample items from the scale include, 'I am likely to get skin cancer sometime during my lifetime' and 'I think skin cancer is a serious disease.'. Each item was assessed using a 5-point Likert response format (1 = strongly disagree to 5 = strongly agree). A total score for perceived threat was obtained by adding scores for all items. The perceived threat construct had a possible score range between 6 and 30 units, with higher scores representing higher perceived threat of skin cancer.

The perceived benefits of sun protection scale (Cronbach's alpha = 0.83) had seven items. Sample items from the scale state, 'If I seek shade, I am less likely to get skin cancer' and 'If I wear a wide brimmed hat, I am less likely to get skin cancer'. Each item was assessed using a 5-point Likert response format (1 = strongly disagree to 5 = strongly agree). A total score for perceived benefits was obtained by adding scores for all items. The perceived benefits construct had a possible score range between 7 and 35 units, with higher scores representing higher perceived benefits of sun protection.

The perceived barriers of sun protection scale (Cronbach's alpha = 0.63) had seven items. Example items state, 'I am not concerned about sun exposure' and 'Sun protective clothing is too hot.' Each item was assessed using a 5-point Likert response format

(1 = strongly disagree to 5 = strongly agree). A total score for perceived barriers was obtained by adding scores for all items. The perceived barriers construct had a possible score range between 7 and 35 units, with higher scores representing higher perceived barriers of sun protection. The score of perceived barriers was subtracted from the score of perceived benefits to achieve the score for the variable perceived benefits minus perceived barriers. Therefore, this variable had a possible score range between −28 and +28 units, with higher positive scores representing perceived benefits outweighing perceived barriers of sun protection.

The self-efficacy to use sun protection scale (Cronbach's alpha = 0.70) had seven items. Example items from the scale include, 'How confident are you to wear a long-sleeved shirt when you are in sun for more than 15 minutes between 10 am to 4 pm' and 'How confident are you to wear long pants when you are in sun for more than 15 minutes between 10 am to 4 pm' Each item was rated using 11 choices (0 = cannot do at all to 10 = highly certain can do). A total score for self-efficacy was obtained by adding scores for all items. The self-efficacy construct had a possible score range between 0 and 70 units, with higher scores representing higher self-efficacy to use sun protection.

The cues to action scale had 12 questions, for example, 'Have you received information from the following sources about protecting yourself from too much sun: radio, television, newspaper, …' Each question had three choices (1 = yes, 0 = no, and 0 = I don't know). A total score for cues to action was obtained by adding scores of all items. The cues to action construct had a possible score range between 0 and 12 units, with higher scores representing higher cues to action to use sun protection.

Covariates

For this study, covariates were selected based on a previously published comprehensive literature review on correlates of sun protection behaviors among outdoor workers (Nahar *et al.*, 2013): age (continuous variable, observed range 18–70 years), gender (male and female), race/ethnicity (dichotomized into White or Caucasian American and other), skin type (dichotomized into low propensity to burn and high propensity to burn), skin cancer history (dichotomized into yes and no/I don't know), sun exposure (workday) (continuous variable, observed range 1–6 h), sun-safety training (dichotomized into yes and no/I don't know), sun-safety policy (dichotomized into yes and no/I don't know), and skin cancer knowledge (continuous variable, observed range 0–10).

Data analysis

SPSS version 21.0 (Chicago, IL, USA) was used for all data analyses. Data were checked for missing values and outliers. Preliminary analyses were performed to make sure there were no violation of assumptions of linearity, homoscedasticity, lack of multicollinearity, and normality. Descriptive statistics were computed for all measured variables to describe and interpret the data. Hierarchical multiple regression was conducted in two blocks to determine the association between the HBM constructs (i.e. independent variables) and sun protection behaviors (i.e. dependent variable) beyond the influence of covariates (i.e. modifying variables based on theoretical underpinnings of the HBM). In block one, the following covariates were entered: age, gender, race/ethnicity, skin type, personal skin cancer history, sun exposure (workday), sun-safety training, sun-safety policy, and skin cancer knowledge. In block two, the following HBM constructs were added: perceived threat of skin cancer, perceived benefits of sun protection, perceived barriers of sun protection, self-efficacy to use sun protection, and cues to use sun protection. For the regression analysis, listwise deletion was used for missing values. A significance level of 0.05 was set *a priori*.

Results

A total of 480 possible state park workers were invited to participate, and 312 returned the survey (65% response rate). Two participants reported being <18 years old, so they were excluded, which resulted in 310 state park workers in the final sample. The average age of the sample was 39.56 (±13.97, range 18–70) years. The majority of participants were male [n = 197 (63.5%)] and most commonly self-identified as White or Caucasian [n = 191 (61.6%)]. One hundred and thirty-five (43.5%) participants were married, 89 (28.7%) were high-school graduates or equivalent, and 110 (35.5%) had household annual income less than or equal to $25 000. The majority of participants [n = 264 (85.2%)] were covered under a health-care insurance plan. Table 1 describes the sociodemographic makeup of the participants.

Regarding skin type, 155 (50%) participants reported high propensity to burn. A total of 29 (9.4%) participants had history of skin cancer and 57 (18.4%) had a family member who had been diagnosed with skin cancer in the past. One hundred thirty-nine (44.8%) participants reported having at least one sunburn during the present summer. During the previous summer, 124 (40%) of participants reported having at least one sunburn. On average, participants reported spending

3.51 (±1.88, range 1–6) h in the sun on a working day between the peak hours of 10:00 am and 4:00 pm. The average hours spent on the weekend or non-workdays between 10:00 am and 4:00 pm was 3.86 (±1.66, range 1–6).

Of the 310 participants, 46 (14.8%) reported that they had their skin checked for changes that could be skin cancer. Thirty-one participants (10%) reported that they had their skin checked by a skin doctor. Seventeen participants (5.5%) had their most recent exam within last year.

Thirty-seven (11.9%) participants reported that their current workplace had a written sun-safety policy (I don't know = 34.5%) and 27 (8.7%) reported that the policy is enforced. A total of 30 (9.7%) participants reported that they have received training on sun-safety in their workplace. The most commonly sun-safety equipment provided to state park workers by their employers included baseball caps [*n* = 145 (46.8%)], long-sleeved shirts [*n* = 163 (52.6%)], work gloves [*n* = 170 (54.8%)], and long pants or full overalls [*n* = 176 (56.8%)]. Most participants responded that they were not provided with a wide-brimmed hat [*n* = 251 (81.0%)] or sunscreen with a SPF of 15 or higher [*n* = 221 (71.3%)].

Table 2 depicts the frequency of specific sun protective behaviors. The most frequent reported sun protective behavior was always wearing sunglasses [*n* = 100 (32.3%)], followed by wearing long pants [*n* = 79 (25.5%)], seeking shade [*n* = 54 (17.4%)], using sunscreen [*n* = 32 (10.3%)], wearing a wide-brimmed hat [*n* = 29 (9.4%)], wearing gloves [*n* = 12 (3.9%)], and wearing a long-sleeved shirt [*n* = 12 (3.9%)].

Table 3 contains the descriptive statistics (M ± SD) of the variables assessing sun protective behaviors, skin cancer knowledge, and HBM constructs. Sun protection behaviors ranged from 7 to 35, with an average score of 19.28 ± 4.81. The skin cancer knowledge variable ranged from 0 to 10, with the average being 6.37 ± 2.92. Perceived threat ranged from 6 to 30 with an average score of 18.84 ± 3.87. Perceived benefits ranged from 7 to 35 with an average score of 21.79 ± 4.91. Perceived barriers ranged from 7 to 35 with an average score of 21.22 ± 4.24. Perceived benefits minus perceived barriers variable ranged from −12 to +28 with an average score of 0.63 ± 6.08. Self-efficacy ranged from 3 to 70 with an average score of 41.80 ± 12.69. The cues to action score ranged from 0 to 12, with the average being 6.12 ± 3.55.

The most common sources of information about sun protection included television [*n* = 258 (83.2%)], friends [*n* = 160 (51.6%)], and family [*n* =171 (55.2%)]. The least common sources about sun protection were employers or supervisors [*n* = 99 (31.9%)], coworkers [*n* = 129 (41.6%)], The American Cancer Society [*n* = 128 (41.3%)], radio [*n* = 137 (44.2%)], and newspaper [*n* = 133 (42.9%)]. Answers were largely divided on the Internet [*n* = 151 (48.7%)], health information pamphlets [*n* = 148 (47.7%)], magazine articles or advertisements [*n* = 147 (47.4%)], and doctors or other health-care workers [*n* = 152 (49%)] as sources of information about sun protection.

Table 4 presents the results of each regression model. For model 1, age (standardized coefficient = 0.167, P = 0.012), race/ethnicity (unstandardized coefficient = -2.685, P < 0.001), sun-safety policy (unstandardized coefficient = 2.724, P = 0.015), and skin cancer knowledge (standardized coefficient = 0.226, P = 0.001) were significantly associated with sun protection behaviors, F (9, 205) = 4.689, P < 0.001, R^2 = 0.171, Adjusted R^2 = 0.134. The addition of the HBM constructs in model 2 led to a statistically significant increase in the R^2 of 0.222. A significant model emerged: F (13, 201) = 9.999, P < 0.001. Model 2 explained 39.3% of the variance in sun protection behaviors (with an adjusted R^2 = 0.353). Of the HBM constructs, perceived benefits outweighing perceived barriers (standardized coefficient = 0.210, P = 0.001), self-efficacy (standardized coefficient = 0.333, P < 0.001), and cues to action (standardized coefficient = 0.179,

Table 2. Frequency (percentage) of sun protection behaviors.

Sun protection behaviors	Never *n* (%)	Rarely *n* (%)	Sometimes *n* (%)	Frequently *n* (%)	Always *n* (%)
Seek shade	13 (4.2)	44 (14.2)	103 (33.2)	94 (30.3)	54 (17.4)
Wide-brimmed Hat	119 (38.4)	55 (17.7)	65 (21.0)	40 (12.9)	29 (9.4)
Long sleeved shirt	147 (47.4)	87 (28.1)	43 (13.9)	19 (6.1)	12 (3.9)
Long pants	52 (16.8)	42 (13.5)	57 (18.4)	76 (24.5)	79 (25.5)
Sunscreen	97 (31.3)	65 (21.0)	75 (24.2)	41 (13.2)	32 (10.3)
Sunglasses	37 (11.9)	32 (10.3)	65 (21.0)	74 (23.9)	100 (32.3)
Gloves	104 (33.5)	67 (21.6)	84 (27.1)	38 (12.3)	12 (3.9)

Due to missing data, the percentage of participants in each category of sun protection behaviors do not sum to 100%.

P = 0.004) were significantly associated with sun protection behaviors.

Discussion

Previous research has shown that there is a substantial relationship between occupations requiring outdoor work and an increase in skin cancer risk (Sendall *et al.*, 2016). To reduce this risk, sun protection behaviors are recommended as the primary prevention method protect oneself against the development of skin cancer. In recognition of the relationship between UVR exposure and sun protection behaviors among state park workers, the present study was carried out to determine what sociodemographic and work-related factors were related to the use of sun protection behaviors among this occupational group. The study used the HBM as a theoretical framework to further explore how various psychosocial factors related to sun protection behaviors among state park workers.

Univariate results showed that the majority of state park workers did not engage in adequate sun protection behaviors. Overall, state park workers in this study reported low frequency of sun protection behavior. The most frequent (i.e. always used) sun protection behavior among state park workers in this study was the use of sunglasses (32.3%); whereas the frequent use of other sun protective behaviors (i.e. using sunscreen, wearing a long-sleeved shirt) was not commonly reported among the sample. Previous studies with other outdoor workers, such as landscapers and construction workers, have also reported similar patterns of sun protection behavior, where sunglass use was more frequently reported than other sun protection behaviors (Salas *et al.*, 2005; Madgwick *et al.*, 2011; Cioffi *et al.*, 2012; Nahar *et al.*, 2013). Although sunglasses are a recommended form of sun protection, it has been suggested that the frequency of sunglass use when compared to other sun protection behaviors among outdoor workers in this study and previous studies may be a result of not only protecting oneself against occupational hazards but also conforming to social norms (Nahar *et al.*, 2013). Among the sun protection behaviors assessed in this study, it is alarming that 52.3% of the state park workers in this study reported never/rarely using sunscreen. This finding is consistent with other research that showed low rates of sunscreen use among other subtypes of outdoor workers (Boyas and Nahar, 2018). Given the low use of sun protection behavior, especially sunscreen, it is important for future research to develop interventions to increase sun protection behaviors among state park workers. One intervention strategy could include the incorporation of on-site sunscreen dispensers with an SPF to be provided onsite to employees, as a form of cue to action. The presence of such dispensers may in turn encourage regular sunscreen application (Sendall *et al.*, 2016). This strategy combined with the encouragement of sun protection through the development of workplace policies, may in turn lead to increased sun protection among this vulnerable occupational group. This would be salient given that in the present study, only a small percentage of respondents reported that their current workplace had written sun-safety policies, nor did they have received training on proper sun safety in their workplace. The incorporation of workplace policies in other countries may help to inform and guide the potential development of workplace strategies in the Southeastern USA. For example, in Australia, the Radiation Protection Standard for Occupational Exposure to Ultraviolet Radiation (Australian Radiation Protection and Nuclear Safety Agency, 2006) provides guidelines for employers and employees regarding minimizing workers' exposure to UVR, which includes the development of workplace policies that identifies the risks associated with UVR exposure and the procedures implemented to reduce and manage the risk.

Table 3. Descriptive statistics of the sun protection behaviors, skin cancer knowledge, and health belief model constructs.

Constructs	Possible range	Observed range	Mean ± SD
Sun protection behaviors	7 to 35	7 to 35	19.28 ± 4.81
Skin cancer knowledge	0 to 10	0 to 10	6.37 ± 2.92
Perceived threat	6 to 30	6 to 30	18.84 ± 3.87
Perceived benefits	7 to 35	7 to 35	21.79 ± 4.91
Perceived barriers	7 to 35	7 to 30	21.22 ± 4.24
Perceived benefits–perceived barriers	−28 to +28	−12 to +28	0.63 ± 6.08
Self-efficacy	0 to 70	3 to 70	41.80 ± 12.69
Cues to action	0 to 12	0 to 12	6.12 ± 3.55

Table 4. Hierarchical multiple regression explaining sun protection behaviors

Variables	Unstandardized coefficient	SE	Standardized coefficient	*P*-value	95% CI	VIF
Model 1						
Age	0.057	0.023	0.167	0.012	(0.013, 0.102)	1.073
Gender	−0.030	0.780	−0.003	0.969	(−1.569, 1.508)	1.488
Race/ethnicity	−2.685	0.749	−0.262	<0.001	(−4.161, −1.208)	1.316
Skin type	1.066	0.704	0.113	0.131	(−0.322, 2.454)	1.366
Skin cancer history	0.265	1.196	0.015	0.825	(−2.093, 2.623)	1.159
Sun exposure (workday)	0.325	0.200	0.130	0.107	(−0.070, 0.720)	1.591
Sun-safety training	−0.115	1.256	−0.007	0.927	(−2.591, 2.361)	1.347
Sun-safety policy	2.724	1.106	0.182	0.015	(0.544, 4.904)	1.349
Skin cancer knowledge	0.366	0.113	0.226	0.001	(0.144, 0.589)	1.200
$F(9, 205) = 4.689$, $P < 0.001$, $R^2 = 0.171$, adjusted $R^2 = 0.134$						
Model 2						
Age	0.069	0.020	0.201	0.001	(0.030, 0.108)	1.106
Gender	−0.434	0.679	−0.043	0.523	(−1.772, 0.904)	1.507
Race/ethnicity	−1.630	0.676	−0.159	0.017	(−2.963, −0.297)	1.437
Skin type	0.777	0.617	0.082	0.210	(−0.441, 1.994)	1.407
Skin cancer history	0.803	1.050	0.046	0.445	(−1.268, 2.875)	1.197
Sun exposure (workday)	0.422	0.177	0.169	0.018	(0.073, 0.770)	1.657
Sun-safety training	−0.746	1.093	−0.044	0.496	(−2.902, 1.409)	1.366
Sun-safety policy	2.310	0.973	0.154	0.019	(0.391, 4.229)	1.400
Skin cancer knowledge	0.126	0.104	0.078	0.228	(−0.079, 0.331)	1.365
Perceived threat	−0.018	0.076	−0.014	0.815	(−0.168, 0.133)	1.140
Perceived benefits–perceived barriers	0.158	0.047	0.210	0.001	(0.065, 0.251)	1.307
Self-efficacy	0.125	0.023	0.333	<0.001	(0.080, 0.170)	1.223
Cues to action	0.239	0.083	0.179	0.004	(0.076, 0.403)	1.262
$F(13, 201) = 9.999$, $P < 0.001$, $R^2 = 0.393$, adjusted $R^2 = 0.353$, $\Delta R^2 = 0.222$, $\Delta F = 18.372$						

SE = standard error of the unstandardized coefficient; 95% CI = 95% confidence interval for the unstandardized coefficient; VIF = variance inflation factor; age (continuous variable, observed range 18–70 years); gender (0 = female; 1 = male; reference category = female); race/ethnicity (0 = other; 1 = White or Caucasian American; reference category = other); skin type (0 = low propensity to burn; 1 = high propensity to burn; reference category = low propensity to burn); skin cancer history (0 = no/I don't know, 1 = yes; reference category = no/I don't know); sun exposure (workday) (continuous variable, observed range 1–6 h); sun-safety training (0 = no/I don't know, 1 = yes; reference category = no/I don't know); sun-safety policy (0 = no/I don't know, 1 = yes; reference category = no/I don't know); skin cancer knowledge (continuous variable, observed range 0–10); perceived threat (continuous variable, observed range 6–30); perceived benefits–perceived barriers (continuous variable, observed range from −12 to +28); Self-efficacy (continuous variable, observed range 3–70); cues to action (continuous variable, observed range 0–12).

Within the context of the low sun protection behaviors reported in the sample, it is not surprising that the 40% of state park workers reported having at least one sunburn in the past year. This finding raises the question of how often these workers visit dermatologists for skin cancer screening. This concern was echoed by another result that shows that although the state park workers in this study had a mean of skin cancer knowledge 6.37 (± 2.92, observed range 0–10) an overwhelming majority [*n* = 244 (78.7%)] of participants reported never having their skin checked for skin cancer. Considering most skin cancer diagnoses are curable with early detection, and that these workers consistently reported getting sun burned, it is imperative that state park workers, who work in a profession that increases their exposure to UVR, receive regular skin cancer screenings (Skin Cancer Foundation, 2016). Future research should assess barriers that may prevent state park workers from receiving regular skin cancer screenings to better understand the low levels of screening history in this study.

In the first multivariable model, age, race/ethnicity, sun-safety policies, and knowledge were significantly associated with sun protection behaviors among state park workers. Of those significantly associated with in the first model, age, race/ethnicity, and sun-safety policies retained significance in the second model, which included the HBM constructs. One of the important findings from this study was with regard to race/ethnicity. Notably, state park workers who identified as White were significantly less likely to engage in sun protection behaviors. This finding is concerning, considering that people with lighter skin phototypes (i.e. identifying as non-Hispanic White) are at an increased risk for skin cancer than those with darker skin phototypes (i.e. African American or Latino) (Skin Cancer Foundation, 2016). Contrary to the findings from the current study, previous studies assessing sun protection behaviors in other outdoor workers have found that those who self-perceived themselves to have a UV-sensitive skin tone were more likely to engage in sun protection behaviors than their counterparts with darker skin phenotypes (Falk and Anderson, 2013; Nahar *et al.*, 2013; Holman *et al.*, 2014). Considering the discrepancy between the findings from this study and previous research, future research should continue to explore the impact of race/ethnicity on sun protection behaviors in populations of outdoor workers. In addition, practitioners and researchers developing interventions for skin cancer prevention among state park workers should focus on increasing awareness of the importance of sun protection behaviors for all employees and especially for those with susceptible phototypes, such as workers who identify as non-Hispanic White.

Another important finding from this study was the statistically significant association between sun-safety policies and the use of sun protection behaviors among state park workers. A positive relationship was found between the presence of a sun-safety policy and use of sun protection behaviors in both multivariable models. The positive relationship between sun-safety policies and sun protection behavior is important and underscores the importance for workplaces that employ outdoor workers to adopt a sun-safety policy. Sun-safety policies include the implementation and enforcement of policies that encourage and reinforce engagement in sun protection behaviors in the workplace, such as the inclusion of 'sunscreen application breaks' during the workday or the provision of sunscreen for employees to use in the workplace (Nahar *et al.*, 2013; Sendall *et al.*, 2016). In addition, to create a workplace environment that supports sun safety for employees, supervisors should encourage sun-safety practices among their employees and engage in role modeling of sun protection behaviors. Previous research suggests that supervisors may play an important role in changing the attitudes and behaviors of employees with respect to sun protection behaviors because they can affect the workplace norms that support increased sun safe strategies (Woolley *et al.*, 2008; Nahar *et al.*, 2013; Sendall *et al.*, 2016; Boyas and Nahar, 2018). Although the findings from this study support the adoption of sun-safety policies in the workplace, it should be noted that a considerable proportion of participants in the sample reported that their workplace did not have a sun-safety policy in place at the time of the study or they did not know whether such a policy existed. Considering the positive relationship between sun-safety policies and sun protection behaviors, future research should explore the barriers to adopting and enforcing sun-safety policies in the workplace and develop strategies to increase the adoption of sun-safety policies by companies employing outdoor workers. This effort though may require government intervention, such as declaring excessive sun exposure as an occupational hazard. In order for employers to institute sun safe policies, the US government may have to place mandates on companies that employ outdoor workers. Our findings indicate that this may help increase the use of sun protective behaviors. This classification may increase the attention given to the heightened risk of developing skin cancer burdened by outdoor workers.

An important finding from this study is the importance of the HBM constructs in further explaining sun protection behavior use by state park workers. The addition of the HBM constructs in the second multivariable model resulted in an R^2 increase of 0.222, which supports the utility of the HBM constructs in explaining sun protection behaviors among state park workers. Several of the HBM constructs, including perceived benefits outweighing perceived barriers, self-efficacy, and cues to action were significantly associated with sun protection behaviors. All of these factors appear to have a positive impact on increased use of sun protection behaviors. Thus, researchers and practitioners aiming to increase sun protection behaviors among state park workers and other outdoor workers may want to consider developing intervention strategies to address these constructs in the HBM. To address perceived benefits outweighing the perceived barriers, intervention programs should inform state park workers about the benefits of engaging in sun protection behaviors to prevent skin cancer while concurrently removing barriers to the engagement in sun protection behaviors in the workplace, such as providing sun protective clothing and sunscreen to all employees and providing employees with time during the workday to apply sunscreen. Further, to reinforce sun protection behaviors in the workplace, intervention strategies can employ the use of cues to action in the workplace. Cues to action include verbal and visual reminders to prompt state park workers to use sun protection behaviors, such as the placement of labels in vehicles or verbal reminders by supervisors and coworkers to engage in sun protection behaviors. Finally, to address the positive relationship between self-efficacy and sun protection behaviors among state park workers, interventions aiming to increase sun protection behavior use through increasing self-efficacy among state parkers should focus on increasing self-efficacy using Bandura's (1977) self-efficacy model by using strategies such as incorporating physiological arousal, verbal persuasion, vicarious experience, and enactive attainment.

Limitations

The findings from this study should be considered within the context of several limitations. First, the data were collected from a nonrandom sample of state park workers from 23 state parks in the southeastern USA. The lack of random sampling for the study limits the generalizability of the findings and may create self-selection bias, as there is potential that participants may have chosen not to participate in the study once they learned about the focus of the study being about sun protection behaviors. A second limitation was inherent to the cross-sectional nature of the study. The collection of cross-sectional data limits the ability to interpret any cause-and-effect relationships. Third, the reliance on self-reported individual data for all variables assessed in this study could have led to the potential for measurement bias. An additional limitation because of the self-reported nature of the study was the potential that recall and social desirability biases may have affected participant responses. Future studies should examine this model with a multilevel data structure, which could elucidate if individual sun protective behaviors are influenced by organizational effects. Another potential limitation may be attributable to the wording of some items used in the preexisting measurement scales and participant interpretation of the items. For example, items regarding self-efficacy addressed participants' confidence with regard to sun protection. Participants may have interpreted the concept of confidence as likelihood or barriers to use rather than self-efficacy. In addition, the instrument contained 73 items, which may have taken participants a long amount of time to complete. This may have caused mental fatigue, which might have affected participant responses and the quality of data collected. Finally, although participants were recruited from 23 different state parks, the participants were only recruited from one region of the USA and may not be representative of all state park workers. Thus, it would be beneficial for future studies to conduct similar research using larger and more geographically diverse samples.

Conclusions

The findings from this study support the utility of the HBM in explaining sun protection behaviors among state park workers. Although the HBM suggests that an individual's likelihood of engaging in a health protective behavior is dependent on perceived threat, this assumption is not supported in the present study. Rather, the findings from this study indicate that other HBM constructs, including perceived benefits outweighing perceived barriers, self-efficacy, and cues to action, may be more important in explaining sun protection behaviors among state park workers. However, due to the limited generalizability of the findings beyond the sample ascertained in this study, future research should test the HBM constructs in explaining sun protection behaviors in random and geographically diverse samples of state park workers. In addition, due to the lack of theoretical underpinning in much of the skin cancer research on outdoor workers (Nahar *et al.*, 2013), future studies should consider additional theoretical frameworks, such as the multi-theory model (Sharma, 2015), to further explore additional theoretical precursors of sun protection behaviors in outdoor workers. The authors recommend that future studies incorporate larger, randomized samples of state park workers and incorporate prospective designs to generate more evidence of a directional or causative relationship between the HBM constructs and sun protection behaviors. Considering the findings related to sun protection policies, future research should further explore the use of sun protection policies in this population and determine strategies to increase adoption of these strategies by employers of state park workers. This will be important given that findings from this study indicate that despite the increased risk of skin cancer among state park workers, they do not engage in adequate sun protection behavior nor preventative behavior through screenings.

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Conflict of Interest

Vinayak K. Nahar, MD, PhD, MS, FRSPH, Amanda H. Wilkerson, PhD, Brian Martin MS, Javier F. Boyas, PhD, M. Allison Ford, PhD, John P. Bentley, PhD, Paul Johnson, PhD, Kim R. Beason, EdD, William H. Black, MD, have no conflict of interests to report. Robert T. Brodell, MD, discloses the following potential conflict of interests: honoraria have been received from presentations for Allergan, Galderma, and PharmaDerm, a division of Nycomed US Inc. Consultant fees have been received from Galderma Laboratories, L.P. Clinical trials have been performed for Genentech and Janssen Biotech, Inc. The material in this paper is not believed to be relevant to any of these reported conflicts.

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